RELIABILITY EVALUATION, CRITICALITY ANALYSIS OF SVC AND FAST PROTECTION ALGORITHM FOR SVC COMPENSATED TRANSMISSION LINE

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Abstract

This article reports a relay algorithm based protection of static var compensator (SVC) based compensated transmission line utilizing artificial neural networks (ANN). The sequentially involved four artificial neural networks (ANNs) are used. The first ANN detects fault and the second ANN classifies it as either a ground or a phase fault. The faulted phases are then detected using ground fault ANN or phase fault ANN, depending on the situation. A transmission line (100 km, 230 kV, 50Hz) is simulated with SVC at the midpoint using a sampling frequency of 1 kHz in PSCAD/EMTDC. The sequence current ratios are used in fast protection algorithm with 100% accuracy in 4 milliseconds and identify them as phase or ground faults in 8 milliseconds. Finally, the identification of the faulted phase/phases requires just 13 milliseconds. Further, the number of thyristor-switched capacitors (TSC) in SVC depends on several factors such as thyristor valve, reactive power output, and electrical network type. However, the effect of the number of TSCs on the SVC reliability and criticality is not found in the existing literature. The reliability of SVC is increased is reported in this work by varying the number of TSC branches. The observations found increase of 15.47% in the SVC reliability by increasing TSC branches from one to three. In this way, the number of TSC branches in SVC can be optimized to increase the system's reliability with minimum cost.

Keywords: Artificial Neural Network (ANN), criticality, pattern recognition, reliability, Static Var Compensator (SVC)

Introduction

Static Var Compensator (SVC) has been used since the 1970s for improving power systems dynamic performance (Ali and Ul Asar, 2013). The effect of SVC in the power system has been studied extensively (Ramana Reddy *et al*., 2014; Ranganathan and Kalavathi, 2014; Adni Binti Mat Le *et al*., 2017; Jumaat *et al*., 2017). However, in an electric power system made up of several dynamic interacting components, there is always the risk of a disturbance or a fault. Faults not only cause damage to the equipment but also result in poor power quality. Power system faults need to be detected and classified correctly to ensure the system's smooth operation and enhance the power quality. The transmission protection system is designed in such a way as to identify the fault and isolate only

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